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Weed Control and Tolerance of Tomato (*Solanum lycopersicum* L.) to Fomesafen

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ABSTRACT

Weed management in tomato (*Solanum lycopersicum* L.) continues to be a challenge for vegetable growers in Ohio. Field experiments were conducted at the North Central Agricultural Research Station in Fremont, OH in 2009 and 2010 to evaluate the tolerance of tomato to fomesafen and the efficacy of this herbicides on weed control. The crop was machine-transplanted in June 5, 2009 and June 3, 2010. The experimental design was a randomized complete block with 4 replications. Pre-transplant treatments were applied on June 4, 2009, and May 27, 2010 and included fomesafen at 280, 350, 420, 560, and 840 g ai ha^{-1}. Crop injury and weed control were assessed visually using a linear scale in which 0 indicated no crop injury or weed control, and 100 indicated death of crop or total weed control. Plots were evaluated at 7, 14, 28, and 42 day after treatment. The crop was harvested on September 16, 2009 and September 30, 2010 and total yield per plot was determined. Minimal crop injury was observed 7 and 14 DAT in plots treated with fomesafen at 840 g ai ha^{-1} both years. However none of the treatments caused crop injury either years at 42 DAT. Fomesafen at the highest rate provided acceptable annual grass, common purslane, and redroot pigweed control 42 DAT. Fomesafen application did not reduce total tomato yield. Registration of fomesafen herbicide would provide tomato growers an opportunity to control weeds caused by late emergence or poor initial control following a burndown herbicide application in tomato.

INTRODUCTION

Tomato is one of the most important and nutritive vegetable crop in the United States (NASS, 2014), and ranks first in terms of economic value as a fresh-market vegetable as well as for processing. Weed management is one of the most costly production practices. Weed management in tomato consists of a combination of herbicides, interrow cultivation (Robinson et al. 2006), and the use of black polyethylene plastic mulch (Lament 1993). Weeds can significantly reduce yield if proper weed control measures are not taken. Fomesafen (Reflex) has been utilized in several crops for control of many broadleaf and grass weed species. Intensive horticultural practices, including effective weed control, are needed for profitable production of tomato. Identification of new herbicides that are safe to tomato yet effectively control a range of weeds is key to a successful tomato production.

OBJECTIVES

To characterize tomato response to fomesafen and gather data needed to support registration of fomesafen.

MATERIALS AND METHODS

- North Central Agricultural Research Station, Fremont, Ohio
- Machine transplanted seedlings on June 5, 2009 and June 3, 2010
- RCBD with 4 replications
- PRETP herbicide applications were made on June 4, 2009 and May 27, 2010
    - CO2 pressurized sprayer, 234 L ha^{-1} at 276 kPa, 8002VS flat fan spray nozzles
- Herbicide rates: 280, 350, 420, 560, and 840 g ai ha^{-1}
- Crop injury and weed Control: 0-100 linear scale
- Crop was harvested on September 16, 2009 and September 30, 2010
- Statistical analysis: PROC GLM and Fisher's Protected LSD test (5%) in SAS 9.2

Table 1. Response of tomato (*Solanum lycopersicum*) to PRETP fomesafen rates and weed pressure at Fremont, Ohio, in 2009 and 2010.

Treatments	Herbicide Rate (g ai ha^{-1})	Injury (%)							
		2009				2010			
		7 DAT	14 DAT	28 DAT	42 DAT	7 DAT	14 DAT	28 DAT	42 DAT
Fomesafen	280	0 b	0 b	0	0	3 b	1 b	0	0
	350	0 b	0 b	0	0	1 b	1 b	0	0
	420	6 ab	0 b	5	0	0 b	0 b	0	0
	560	6 ab	0 b	0	0	1 b	1 b	1	0
	840	13 b	4 a	4	0	14 a	8 a	1	0
Weed Free Control		0	0	0	0	0	0	0	0
Weedy Control		0	0	0	0	0	0	0	3
LSD (0.05)		5	1	NS[a]	NS	5	4	NS	NS

Table 2. Yield of tomato (*Solanum lycopersicum*) in response to PRETP fomesafen and weed pressure at Fremont, Ohio in 2009 and 2010.

Treatment	Herbicide Rate (g ai ha^{-1})	Yield per plot (kg)	
		2009	2010
Fomesafen	280	12.5 a	19.8 ab
	350	13.2 a	17.1 bc
	420	12.6 a	16.5 c
	560	14.4 a	20.9 a
	840	12.9 a	19.0 abc
Weed free control	-	14.8 a	18.0 bc
Weedy control	-	6.7 b	13.2 d
LSD (0.05)	-	4.0	3.7

Figure 1. Weed control and tolerance of tomato (*Solanum lycopersicum*) in response to PRETP fomesafen at Fremont, Ohio in 2009.

Table 3. Effect of PRETP fomesefan rates on broadleaf and grass weed control in tomato (*Solanum lycopersicum*) at Fremont, Ohio in 2009.

Treatment	Herbicide Rate (g ai ha^{-1})	Weed control (%) in 2009							
		28 DAT				42 DAT			
		AG[b]	CA[c]	PO[d]	AM[e]	AG	CA	PO	AM
Fomesafen	280	0 b	0 c	0 c	25 b	5 b	20	23 b	25 b
	350	26 b	0 c	41 bc	50 ab	14 b	0	20 b	25 b
	420	5 b	18 bc	35 bc	79 a	5 b	20	43 ab	25 b
	560	34 b	35 b	75 ab	99 a	20 b	19	65 ab	98 a
	840	83 a	85 a	92 a	99 a	75 a	5	85 a	98 a
Weed Free Control	-	100	100	100	100	100	100	100	100
Weedy Control	-	0	0	0	0	0	0	0	0
LSD (0.05)	-	41	32	45	51	19	NS	47	41

Table 4. Effect of PRETP fomesafen rates on broadleaf and grass weed control in tomato (*Solanum lycopersicum*) at Fremont, Ohio in 2010.

Treatment	Herbicide Rate (g ai ha^{-1})	Weed control (%) in 2010							
		28 DAT				42 DAT			
		AG	CA	PO	AM	AG	CA	PO	AM
Fomesafen	280	0 c	-	56	-	45 b	-	0 b	-
	350	43 abc	-	49	-	43 b	-	26 b	-
	420	20 bc	-	45	-	60 b	-	5 b	-
	560	56 ab	-	66	-	63 ab	-	34 b	-
	840	64 a	-	63	-	91 a	-	83 a	-
Weed Free Control	-	100	-	100	-	100	-	100	-
Weedy Control	-	0	-	0	-	0	-	0	-
LSD (0.05)	-	43	-	NS	-	29	-	41	-

[a] NS = Non-significant F-test at P = 0.05
[b] Annual grasses: green foxtail (*Setaria viridis*) and giant foxtail (*Setaria faberii*)
[c] CA: common lambsquarters (*Chenopodium album*)
[d] PO: common purslane (*Portulaca oleracea*)
[e] AM: redroot pigweed (*Amaranthus retroflexus*)

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RESULTS

- Visual assessments of tomato response to PRETP rates of fomesafen indicated that crop tolerance was excellent (Table 1).
- Symptoms of fomesafen injury at the 840 g ai ha^{-1} were observed at 7 and 14 DAT both years (Table 1).
- Crop recovered from fomesafen injury by 28 DAT, and by 42 DAT no foliar symptoms were observed either year (Table 1).
- Tomato marketable yield in plots treated with PRETP rates of fomasefan was higher from that of the weedy control plots in both years (Table 2).
- Plots treated with fomesafen at the 560 g ai ha^{-1} rate in 2010 produced higher total yield compared to the weed free control plots (Table 2).
- Fomesafen at the 560 and 840 g ai ha^{-1} rates provided at least 98% redroot pigweed control 28 and 42 DAT in 2009 (Table 3).
- Fomesafen at the 840 g ai ha^{-1} rate provided acceptable common purslane and annual grass control in 2009 (Table 2).
- Overall weed densities were very low in 2010.
- Fomasefan at the highest tested rate provided excellent weed control for annual grasses and common purslane 42 DAT in 2010 (Tables 3 and 4).

CONCLUSIONS AND DISSCUSION

- PRETP rates of fomesafen can provide commercially acceptable control of giant and green foxtail, common purslane, and redroot pigweed.
- PRETP rates of fomesafen do not provide an acceptable control for common lambsquarters.
- The lower PRETP rates of fomesafen may be appropriate when overall weed pressure is very low and not severe.
- Slight tomato injury due to PRETP rates of fomesafen was only observed 7 and 14 DAT.
- Using fomesafen may help in herbicide resistance weed management.
- Registration of fomesafen herbicide at the tested rates would provide tomato growers with an alternative herbicide for controlling emerged weeds.

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